

6. ENGINEERING SYSTEMS REQUIREMENTS

D30 HVAC

Refer to Part 4 Section D30 for performance requirements of the building elements included in the HVAC system.

SYSTEM DESCRIPTION

Provide heating, ventilating and air conditioning (HVAC) systems for the MSAU HQ-BEQ that attains the following objectives: Occupant comfort, Indoor air quality, Acceptable noise levels, Energy efficiency, Reliable operation, and Ease of maintenance. Design and installation shall be in accordance with IMC, UFC 3-401-01, *Mechanical Engineering* and UFC 4-721-10, *Navy and Marine Corps Bachelor Housing*. Refer to Building Requirements, Space Tabulations Section of the Project Program for building occupancy levels.

Direct expansion multi-zone systems, direct expansion variable air volume systems, and thru-the-wall units are not acceptable.

Fan Coil Unit System Description: All conditioned spaces within the MSAU HQ-BEQ with the exception of the Mechanical room, Fire Pump room, Telecommunication/Data/NMCI room, and Electrical room, shall be heated and cooled by four-pipe fan coil units. All fan coil units shall be provided with chilled and hot water coils, shall operate independently, and shall be controlled by wall mounted adjustable temperature sensors. Chilled and hot water piping systems to the fan coil unit coils shall be designed as a reverse return system. Cooling coil condensate from the fan coil units shall be routed to a condensate main, and then to the sanitary system. Provide drain pans under all chilled water fan coil units and chilled water connections mounted above ceilings. All fan coil units shall be accessible for maintenance. Access to fan coil units located above ceilings shall be through lockable and hinged ceiling access panel(s) of sufficient size to allow removal of mechanical equipment without damage or demolition of ceiling. Cooling for the fan coil units shall be provided by chilled water and heating shall be provided by hot water.

Ventilation Systems: Outside ventilation air for the MSAU HQ-BEQ shall be provided by an independent and dedicated outside air unit (DOAS), and shall comply with the latest edition of ASHRAE 62. Maintain a constant volume of outside ventilation air to each Room Plan and all other spaces. Each Room Plan shall be provided with a minimum of 110 CFM of ventilation air. Corridors shall be used to provide ventilation air to provide 15% more outside air than exhaust air for the entire building. The DOAS shall preheat, cool, and reheat to neutral conditions all outside ventilation air prior to entering a space. Locate mechanical equipment rooms throughout the MSAU HQ-BEQ as necessary. Attic space may be used for mechanical equipment if there is suitable access for maintenance purposes to permit passage of mechanical equipment from the mechanical rooms to the exterior of the building without disturbing the building's fixed interior components. All cooling coil condensate from the dedicated ventilation system(s) shall be routed to a floor drain.

Fan coil units for the Room Plans, Offices, Multi-purpose room, Public spaces, Lobbies, and Corridors shall return air back to the fan coil units through filter grilles. Provide each Room Plan closet with a minimum 20 CFM of exhaust.

Fan coil unit(s) for the Laundry room shall return air back to the fan coil unit(s) through filter grille(s). No conditioned air from the laundry room fan coil unit(s) shall be returned or transferred to other spaces. Makeup air to the dryer will be brought in through outside air louvers communicating with the space behind the dryers

The Telecommunication/Data/NMCI room shall be cooled and heated via a ductless split heat pump.

Exhaust Systems: Provide continuous exhaust air for the Room Plan bathrooms, Janitor's room, Public Head, and Duty Office Head. The exhaust air for these spaces shall be sent through the DOAS to exchange heat between the outgoing exhaust air and the incoming ventilation air. Continuous exhaust air for the Room Plan bathrooms shall be 50 CFM for the toilet room and 20 CFM for the shower area. Continuous exhaust air for the Public Head, Duty Officer Head, and Janitor's room shall be 50 CFM. Static pressures for these spaces shall be negative as compared to adjacent spaces.

Energy Recovery System: Provide total energy (enthalpy) type energy recovery wheels (heat wheels) in the air handling system for recovering energy between the outgoing exhaust air and the incoming ventilation air. Provide sensible type energy recovery wheels (heat wheels) in the air handling system between the incoming exhaust air and the leaving ventilation air to provide free reheat. The heat wheel(s) shall be located in the DOAS and shall be easily accessible for maintenance.

Mold and Mildew: The MSAU HQ-BEQ shall have no evidence of mold or mildew due to condensate moisture on indoor surfaces after one year of service.

GENERAL SYSTEM REQUIREMENTS

Provide UFC required working space around all equipment. If equipment type clearance requirements are not listed in applicable UFCs provide manufacturers recommended working clearances. Provide all required fittings, connections and accessories required for a complete and usable system. All equipment shall be installed per the criteria in RFP Section D30 and the manufacturer's recommendations. Where the word "should" is used in manufacturer's instructions, substitute the word "shall".

Provide air conditioning and heating for spaces as indicated and for the following design conditions:

Outside Conditions

Summer DB/MCWB	92.6	Degrees F dry bulb	Winter	16.3	Degrees F
	76.4	Degrees F wet bulb			
Summer WB/MCDB	89	Degrees F dry bulb			
	79.4	Degrees F wet bulb			

Room Plans, Offices, Laundry Room, Multi-Purpose Room, Janitor's Room, Corridors, and Storage Rooms Inside Conditions

Summer	76.0	Degrees F dry bulb	Winter	68.0	Degrees F
	50	%RH			

NMCI/Data/Telephone Room Inside Conditions

Summer	75.0	Degrees F dry bulb	Winter	45.0	Degrees F
	50	%RH			

Mechanical, Electrical, and Fire Pump Room Heating & Ventilating Inside Conditions

Summer	10.0	Degrees F dry bulb Above Ambient	Winter	45.0	Degrees F
	10	Air changes per hour			

Other than requirements previously described, provide outside air ventilation rates and systems per ASHRAE Standard 62, *Ventilation for Acceptable Indoor Air Quality*.

Supply ventilation shall be provided for the mechanical room if it contains natural draft fuel-fired equipment, and exhaust ventilation for the electrical room to limit the temperature to no more than 10 degrees F above ambient.

Exhaust ventilation for the mechanical room shall be provided if there is ducted combustion or no fuel-fired combustion equipment present.

Provide summer ventilation rates for the mechanical and electrical room at a minimum of 10 air changes per hour.

The Mechanical room and Fire Pump room shall be heated with hot water unit heater(s) and controlled by a wall mounted thermostat.

The electrical room shall be heated by electric unit heater(s) and controlled by a wall mounted thermostat.

The HVAC system for the MSAU HQ-BEQ shall provide each zone with the choice of heating or cooling year round unless otherwise indicated. Each zone shall have its own limited range of control, as allowed by the control system central workstation.

Zone the HVAC system as follows:

Each Room Plan shall be a separate zone.

Each Office shall be a separate zone.

The Laundry Room shall be a separate zone.

The Multi-Purpose Room shall be a separate zone.

Corridors shall be separate zones.

The Telecommunication/Data/NMCI room shall be a separate zone.

Elevator equipment room shall be a separate zone.

The Mechanical room, Fire Pump room, and the Electrical room shall each be a separate zone, heated and ventilated only.

Noise levels shall comply with the requirements in the ASHRAE Applications Handbook for Hotels/Motels for residential spaces and offices as applicable.

Material and Equipment Qualifications: All materials and equipment shall have been in satisfactory commercial or industrial use for two (2) years prior to the bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures during the 2-year period.

Provide housekeeping pads under all floor-mounted equipment.

The contractor shall comply fully with DoD Instruction 8551.01 Ports, Protocols, and Services Management.

All equipment must be accessible for service without dismantling other equipment.

D3010 ENERGY SUPPLY

D301002 GAS SUPPLY SYSTEM

Obtain natural gas pressures from the local natural gas utility provider, Columbia Natural Gas. Contractor is responsible for providing any applications and permits and shall provide the complete natural gas system from the load side of the utility meter to the heating equipment. The Contractor shall have the local natural gas utility provider install piping and appurtenances up to the load side of the meter.

The Contractor shall coordinate with the Base Energy Manager through the Contracting Officer prior to setting up a new account with Columbia Gas.

Refer to meter communication requirements in D306001.

D301005 SOLAR ENERGY SUPPLY SYSTEMS

Provide a complete solar domestic hot water system including heating panels, roof supports, piping, pumps, hot water storage tanks, heat exchangers and controls. Provide a system designed to furnish a minimum of 30% of the daily demand for domestic hot water for the MSAU HQ-BEQ building. Provide energy meter tied into the EMCS at solar domestic heat exchanger connection to domestic heating water system.

The MCESG Annex is not required to have solar domestic hot water production.

If the solar domestic hot water system is located on the roof, provide a coordinated design of the roof elements and per UFC 3-110-3 Roofing. Organize the roof space necessary to accomplish the functions the roof has to provide, minimize roof penetrations, and plan the roof to facilitate future reroofing of the facility. The roof type selection and detailing of roof mounted equipment shall be made to compliment the implementation of the functions that have to take place on the roof and minimize the need for routine maintenance.

D3020 HEAT GENERATING SYSTEMS

The heating load for this facility shall be served by two (2) boilers, each providing 65% of the load.

Provide shot type feeder for manual chemical feed for closed loop system.

D302001 BOILERS

Provide a minimum of two (2) packaged gas fired condensing hot water boiler(s), per building (MSAU HQ-BEQ and MCESG Annex) each sized at 65% of the heating load, in a variable primary pumping configuration. System return water temperature shall be a maximum of 110 Degrees F.

D302004 AUXILIARY EQUIPMENT

Provide hot water to domestic hot water heat exchangers for the MSAU HQ-BEQ.

D302005 EQUIPMENT THERMAL INSULATION

Provide insulation for hot water pumps and other associated heating equipment.

D3030 COOLING GENERATING SYSTEMS

D303001 CHILLED WATER SYSTEMS

Provide a scroll air-cooled chiller per building, using a variable primary pumping system. The cooling load for each facility shall be served by one (1) chiller providing 100 % of the load. The air-cooled chiller(s) shall be located outside on a 150 mm (6 inch) thick reinforced concrete housekeeping pad. Provide heat tape for freeze protection of chilled water piping and any other associated appurtenances.

Total chilled water system volume shall be a minimum of 7 gallons per ton of cooling.

Chiller(s) shall operate in temperatures down to 0 degrees F.

Provide factory corrosion protection coating on coils.

Provide insulation and vapor barrier on all chilled water equipment.

Provide chiller controls in compliance with ASHRAE 135 *BACnet - A Data Communication Protocol for Building Automation and Control Networks*.

Provide complete start-up and operational testing of chiller equipment.

D303002 DIRECT EXPANSION SYSTEMS

Provide a direct expansion ductless split cooling only unit for cooling the Telecommunications/Data/NMCI rooms, electrical rooms, and elevator equipment rooms. The ductless split cooling only unit shall cool all telecommunication/data/NMCI equipment loads within the rooms. Provide with a wall mounted adjustable thermostat.

D3040 DISTRIBUTION SYSTEMS

D304001 AIR DISTRIBUTION, HEATING & COOLING

Provide insulated, galvanized steel ductwork constructed, braced, reinforced, installed, supported, and sealed per the IMC and SMACNA standards.

Provide grilles, registers, and diffusers. Provide filter grilles for return air.

D304003 HOT WATER DISTRIBUTION SYSTEMS

Provide a variable primary pumping system with two (2) pumps per building to serve the HVAC hot water equipment throughout the facility. Provide insulated copper hot water supply and return piping to serve the HVAC equipment throughout the facility.

Provide air control and shot type feeder for manual chemical feed for hot water piping system.

Provide an expansion tank for the hot water piping system.

Provide system flushing and start-up for the hot water piping system.

D304006 CHILLED WATER DISTRIBUTION SYSTEMS

For exterior buried chilled water distribution systems, coordinate with Section G30, *Site Civil/Mechanical Utilities*.

Provide a variable primary pumping system with two (2) pumps per building to serve the HVAC chilled water equipment throughout the facility.

Provide steel or copper chilled water supply and return piping to serve the HVAC equipment throughout the facility. Insulate piping with cellular glass insulation.

Provide air control and shot type feeder for manual chemical feed for the chilled water piping system.

Provide an expansion tank for the chilled water piping system.

Provide system flushing and start-up for the chilled water piping system.

D304007 EXHAUST SYSTEMS

Central Exhaust System: Provide a ducted central exhaust ventilation system(s) and exhaust fan(s) to serve all ventilated zones of each facility. Provide centrifugal exhaust fan(s) for the MSAU HQ-BEQ and MCESG Annex central exhaust systems. The central exhaust systems shall capture all Room Plan bathroom, public restrooms, and other space exhaust air, and route it through a total energy (enthalpy) type energy recovery wheel (heat wheel) before exiting the MSAU HQ-BEQ in order to gain heat transfer between the incoming ventilation air and outgoing exhaust air. Laundry air is not to be connected to the central system. The central exhaust system ductwork may be routed through a chase adjacent to the Room Plan showers as shown on attached sketches in part three of the project program.

Specialized Exhaust Systems: Provide separate space flush out system for the MCESG Annex that provides 10 air changes/hour for the entire building. Space flush out makeup air is allowed to come from exterior doors and openings such as operable windows. Space flush out system shall be enabled from push button in mechanical room.

Stacked Dryer Exhaust System: Exhaust air from the stacked dryers in Laundry room shall discharge directly to the outdoors. Provide dryer plenum/chase areas as shown in Part 6. Dryer exhaust ducts shall route through dryer plenum/chase area to an exterior intake/exhaust louver. Dryer intake air shall be drawn into the dryer plenum/chase area through the exterior intake/exhaust louver and enter the rear of the dryers. This method prevents the need for conditioning dryer makeup air.

D304008 AIR HANDLING UNITS

Provide separate and independent constant volume air handling unit(s) to serve the ventilation requirements of the MSAU HQ-BEQ and MCESG Annex. The ventilation air handling unit(s)/DOAS shall be provided with preheat and reheat coils, chilled water coil, total enthalpy wheel, sensible wheel, supply fan, and exhaust fan. The unit shall preheat, dehumidify, and reheat ventilation air to neutral conditions prior to delivery within the MSAU HQ-BEQ and MCESG Annex. Neutral conditioned air is defined as air that is 70 degrees Fahrenheit. All incoming outside ventilation air shall be routed through a total enthalpy heat wheel prior to entering the air handling unit(s) in order to exchange heat between the exhaust air and ventilation air. A sensible wheel will also be provided to provide free reheat after the cooling coil. Provide the ventilation air handling unit(s) with a minimum of MERV 8 filters.

D304090 OTHER DISTRIBUTION SYSTEMS

Provide base mounted circulating pumps with variable frequency drives.

Provide chemical treatment systems for the hot and chilled water systems.

D3050 TERMINAL & PACKAGE UNITS

D305002 UNIT HEATERS

Provide hot water unit heater(s) to serve the heating requirements of the Mechanical and Fire Pump rooms.

D305003 FAN COIL UNITS

Provide 4-pipe horizontal type fan coil units and controls to serve the heating and cooling requirements of the facility. Provide each fan coil unit with a return filter grille to ease maintenance requirements. Provide horizontal fan coil units in the overhead with a means for removal and maintenance of the units through lockable access panels where installed above a hard ceiling. Provide auxiliary drain pans below valves and appurtenances to prevent piping leaks and condensate forming on chilled water piping from damaging ceilings.

D305005 ELECTRIC HEATING

Provide an electric unit heater(s) for heating the electrical room space.

D3060 CONTROLS AND INSTRUMENTATION

New Industrial Control System (ICS) shall seamlessly integrate into existing primary MCB Quantico EMCS application database, utilizing existing communication infrastructure, network protocols, and data storage. If existing communication infrastructure is not available, then contractor shall provide.

New Industrial Control System (ICS) shall seamlessly integrate into existing MCB Quantico EMCS cybersecurity authority to operate (ATO), or in progress ATO package. Existing or in progress Cyber security package's for EMCS should simply require an update for any new EMCS to be added to existing EMCS system. Contractor shall provide update and all support needed to achieve approval for updated cyber security Authority to Operate for existing EMCS system.

D306001 HVAC CONTROLS

D306001 1.1 DIRECT DIGITAL CONTROLS (DDC)

Provide a complete ASHRAE 135 compliant Direct Digital Control (DDC) system to comply with UFGS 23 09 23.13 20 BACnet Direct Digital Control Systems for all HVAC systems in this facility unless noted otherwise in the D306001 1.2 ELECTRONIC CONTROLS paragraph below.

The building DDC system shall control the building mechanical systems to maximize energy performance. Occupancy schedules and profiles shall be accounted for in the optimization of building DDC system schedules and reset sequences.

The building DDC shall use Ethernet IP or BACnet IP at the building and management levels.

The DDC system shall operate successfully for 45 consecutive calendar days prior to acceptance by the Contracting Officer's Technical Representative (COTR). Provide trend data to document HVAC system performance during various modes of operation. Refer to RFP Part 5 PS Section 23 0923.1320 "BACnet Direct Digital Control Systems for HVAC."

Design Submittal

Utilize UFGS Specification 23 09 23.13 20 BACnet direct digital control systems for HVAC, for the project specification, and submit the edited specification section as a part of the design submittal for the project.

Contractor's Qualifications

The controls subcontractor for this project shall be regularly engaged in the design and installation of BACnet DDC systems for building HVAC systems in a network of multiple buildings similar to the size and scope of this project, shall have been a representative of the proposed control system manufacturer for a minimum of two (2) years, have a staffed office within a 75-mile radius of the project location, and shall have performed design and installation of DDC systems for a minimum of five (5) years. The controls sub-contractor shall ensure that their installing electricians have a copy of, have read and understand the mechanical sheets of the contract's design construction drawings in addition to the control drawings prepared by the sub-contractor.

Submit documentation certifying the controls Contractor performing the work has:

- A. Completed at least five (5) EMCS/DDC/ICS systems installations of a similar size/design to this project, based on an open Architecture, BACnet IP or Ethernet IP model over the previous three (3) years.
- B. Programmed/configured similar sequences of operation.
- C. Designed an EMCS compliant with IA controls for a MAC II, sensitive level system.
- D. Supported Government efforts to achieve an "Authorization to Operate" (ATO) for a similar EMCS.
- E. Permanent full-time staff with expert knowledge using MCCAOST software to document and administer the Marine corps IA process.
- F. Permanent full-time staff with expert knowledge of the following U.S. Government and DoD policies and instructions:
 - 1. DoD Directive 8500.01E.
 - 2. DoD Instruction 8510.01.
 - 3. DoD Instruction 8551.01.
 - 4. DoD Instruction 8500.2.
 - 5. DoD Directive 8570.10.
 - 6. NIST 800-53.

7. NIST 800-82.

- G. Permanent full-time staff that possesses IAM/ISSM and IAT level III Certifications as defined by DoD Directive 8570.10 Information Assurance (IA) Training, Certification, and Workforce Management, August 15, 2004.
- H. Permanent full-time staff that possesses experience with Supporting Certification and Accreditation (C&A) assessments by government resources as part of the ATO process.

During the Design Phase, provide mechanical flow schematic control diagrams for each system and subsystem with DDC controls (e.g. heating water system, air handling units, chilled water system, condenser water system, etc.). The diagrams shall include all input (temperature sensors, humidity sensors, smoke detectors, pressure sensors, flow meters, utility meters, override switches, etc.) and output (valves, dampers, etc.) control components. The diagrams shall indicate a unique designation for each item and show the relative position of each component within the control system.

Provide a written sequence of operations for each system and subsystem with DDC controls. Indicate within the sequence how each component shall operate from full load to part load, in heating season and in cooling season, at all possible environmental conditions, in all possible modes of operation (e.g. occupied, unoccupied, morning warm-up, start-up, night setback), and during all possible alarm modes (e.g. component failure, smoke detection, etc.). Indicate all control interlocks. Describe how the system accomplishes temperature control.

Provide an input/output (I/O) points list for each system and subsystem with DDC controls. The point lists shall include all inputs (temperature, humidity, pressure, actuator positions, flow rate, equipment proofs, etc.) to the DDC controller, outputs (actuators, valves, damper, etc.) from the DDC controller, and hardwired safeties (smoke detectors, freeze stats, etc.). The points list shall describe each point (supply fan status, chilled water supply temperature, etc.) and the point type (digital input-DI, analog output-AO, etc.). The point lists shall indicate each point that is to generate an alarm when operating outside defined parameters.

Provide site plans indicating network route paths with exact location indicators.

All of the information indicated above (edited specification, flow schematic control diagrams, sequence of operations, and points lists) is required for the design to be approved. It is not acceptable to only submit the control contractor's shop drawings after design completion. Provide the same information in construction submittals, indicating understanding of the information on the design drawings.

Operator Workstation

Provide operator workstation (OWS) and notebook (laptop) computer and complete application software with all licenses. Locate OWS in government approved location. Workstation software shall allow monitoring and troubleshooting of the DDC system and adjustment of set points, operation schedules, control graphics, and control programs. DDC software shall allow for modification to dead band limits and spans, time, timed local override time, alarm points, trend points, runtime accumulation, calculated energy consumption or input, and passwords. Provide editing capacity for creating, deleting, and modifying graphics and text. Provide three levels of password protection to limit access to authorized personnel.

Provide color graphics for each of the building's mechanical systems and DDC system control panels. The current value, set point, and point name of every input and output point shall be shown on at least one graphic in its appropriate physical location relative to the mechanical system. Graphics shall have an associated identifying title. Point data shall be updated dynamically on the graphic images. Provide hierarchical-graphical navigation of the system. Utilize A&E CAD floor plans to provide graphic representations of the floor plans that allow the

operator to see heating or cooling zone temperatures, set points, and locations where temperature and/or other alarms/problems have occurred. Provide visual indication of each point in alarm.

Provide appropriate rates of actuation, hardware, and software to avoid hunting and nuisance trips for freeze safety devices.

For government review, submit the proposed OWS graphic interface and product data for all information system equipment and software.

The BAS owner shall determine the location of all computer devices.

Energy Management and Base DDC Integration

The building DDC system shall be seamlessly compatible with the existing Base Energy Management Control System (EMCS) Network. The Base EMCS Network consists of building HVAC control devices connected via LAN to a central, Siemen's Apogee application Database. The Siemen's Apogee Database is a, government-owned, government-operated network.

The existing Base EMCS Network shall be coordinated through G6 and public works. All network and computer/peripheral equipment must meet shall meet current cyber-security Authority to Operate (ATO), requirements, contractor shall provide all support to achieve the ATO.

After the contract award, the Contractor's Basis of Design shall include a thorough explanation of how a successful, seamless interface between the new and existing DDC systems will be accomplished. As part of construction, provide:

- 1) Advanced proof (including an existing case study) that the system blends seamlessly with the servers, network and Siemens application Database. This shall be submitted for Government approval.
- 2) Thorough testing and advanced commissioning that shall include vendor supported technicians from both systems (the building DDC and Siemen's Apogee Database if these are not from the same vendor as the MCB EMCS) once the integration is complete, to achieve a fully functional local and remotely controlled systems. A thorough testing of all integrational functionalities shall be performed.

The contractor shall provide a 60 days' notice for network connection. All network devices shall be configured by the MCB Quantico G6 TMB.

Terminate all DDC Panel home runs in the base telecommunications closet, MPOP (Minimum Point of Presence) to a government-approved (contractor-provided) network switch.

Provide DDC software license and configure DDC monitoring to Public Works.

Quantico MCB BACnet Naming Convention

Utilize the existing points naming convention from the matrix that is standard for Quantico MCB (available from Quantico Public Works Department after award), subject to government approval. The contractor shall adhere to the BACnet Device numbering sequence and submit the updated MCBQ spreadsheet provided by the government to ensure there are no default or duplicate address numbers. Provide unique BACnet naming ID sequences in accordance with the following Quantico standard: Bldg Name, BLdg #, BLN Name, Assigned Insight, Insight Instance #, Site Name, Field Panel Name, Field Panel IP Address, Field Panel Instance #, Field Panel Mac Address, MSTP/FLN Network #, FLN Device Name, FLN Device Instance #, FLN Device Mac Address, Application #.

Quantico MCB BACnet Device Instance Number address

The contractor shall coordinate with the BAS owner and shall follow Quantico Device Instance Numbering spreadsheet. The contractor shall work with in detail the BAS owner to ensure the BACnet device instance numbering spreadsheet has no duplications. The contractor shall ensure all third party devices are configured properly with no global broadcast features.

Trend Reports

Provide software to produce trend reports for any variable controlled or measured by the system including but not limited to alarm status, measured temperature, set points, actuator positions, etc. Provide easy startup with user adjustable duration and frequency for variable trending. Trend reports shall include data automatically saved into a Microsoft Excel spreadsheet file format as well as automatically generated trend graphs.

Control Panels

Provide 20-percent spare memory, input connection, and output connection capacity for future expansion within each DDC control panel. Provide panels capable of standalone operation, digital and analog input and output, custom control, trending, manual override, with communication ports and keypad interface and digital display, adjacent to the equipment they control.

Utility Meters

Provide utility grade metering devices for building consumption of gas, water and electricity and integrate into the Advanced Metering Infrastructure (AMI) application/servers/network at MCB Quantico.

Any new metering system shall seamlessly integrate into existing primary MCB Quantico AMI application database, utilizing existing communication infrastructure, network protocols, and data storage. If existing communication infrastructure is not available, then contractor shall provide.

Any new metering system shall seamlessly integrate into existing MCB Quantico AMI cybersecurity authority to operate (ATO). Existing Cyber security package for AMI should simply require an update for any new AMI to be added to existing AMI system. Contractor shall provide update and all support needed to achieve approval for updated cyber security Authority to Operate for existing AMI system. Provide interface with water meters in makeup water stations. Provide pulse type water meters in makeup water stations. Provide the ability to read total and instantaneous water flows. Provide venture flow meters for heating water system water flow measurement. Provide items necessary to translate differential pressure across flow meter to electronic signal for digital control system. Provide input from flow meters to digital control system.

All network devices shall be configured by the MCB Quantico G6 TMB/G5.

For government review, submit product data for metering devices and associated network interface switches.

Alarms

Hardwire critical alarms such as low temperature limits, smoke dampers, smoke detectors, and refrigerant leak detectors. Also, provide an individual alarm point for each critical alarm in the DDC system. Include, at no addition to the contract sum, 40 hours for custom alarm programming in close coordination with end users identified by the Contract Officer. Interview users to determine which alarms are of significance to key individuals and provide custom

programming to initiate communication with these individuals upon the activation of specific alarms via cell phone, email, or other communication protocol designated by the users.

Motors

Provide controls to automatically start standby motors (pumps or other HVAC equipment) if the primary device fails. Primary and standby equipment circuits shall be wired to prevent both pieces of equipment from operating simultaneously. Rotate primary and back-up HVAC equipment on a weekly schedule of 168 hours (adjustable) with a lead/lag control routine.

All variable frequency drives shall be controlled directly by the DDC system.

Provide current sensing transducers to monitor all constant speed pump, fan, and air handling unit motors. Provide an input to the DDC control system from each transducer.

Provide a DDC option for automatic operation of building circulating pumps whenever outdoor air temperature is below 35 degrees F or when there is a high potential for freeze damage.

Airflow Monitoring

Provide airflow measurement for outdoor airflow to the DOAS. Airflow measurement shall consist of an array of pairs of temperature compensating bead in glass thermistors and a microprocessor based transmitter. The transmitter shall be factory calibrated to weight the input of each temperature compensating thermistor pair. Error of the thermistor array and transmitter shall not exceed 5-percent of the reading at any point in the airflow measurement range. Provide linear output from each transmitter as an input to the direct digital control system.

Control Valves

Provide manual shut-off valves at each port of control valves. Provide unions for piping DN50 (NPS 2) or smaller and flanges for piping DN65 (NPS 2-1/2) and larger to facilitate removal of control valves without disassembling piping. Provide control valves with equal percentage characteristics and tight shutoff. Provide valve pressure drop at a design flow rate equal to that of the device controlled subject to a high limit of 34 kPa (5 psi).

Control Dampers

Provide low leakage control dampers with airfoil blades and edge seals. Provide end switches for each smoke damper (and other dampers capable of isolating air handling units) to ensure that the dampers are proven fully open before the associated fan starts.

Temperature Sensors

Provide discharge/supply temperature sensors at each dedicated outside air handling system (DOAS) and Fan Coil Unit.

Provide wall-mounted room temperature sensors with set point adjustment and plug-in terminal port under the cover in each zone. At a minimum, temperature sensors shall be DDC monitoring and provide control of room temperature, occupied/unoccupied mode, cooling/heating mode and be capable of remote temperature band limitation. Provide temperature sensors with an unoccupied over-ride switch, which when activated, shall place the locally controlled HVAC equipment in the occupied mode for a pre-determined time period. All temperature sensors in spaces accessible to the general public shall be provided with lockable, vented clear plastic covers designed to prevent tampering.

Training

The Contractor shall conduct training for designated personnel in the operation and maintenance of all equipment installed under this contract, to include, but not be limited to the following: chiller, VFDs, and the control system.

The Contractor shall provide a Chiller Training Plan, a Chiller/Compressor Training Schedule and a Chiller/Compressor Training Manual as deliverables. The training shall include:

- Training instructors shall be manufacturer certified instructors

- The training is to be provided following installation of the equipment, but prior to the acceptance tests.

- Teaching students how to install, operate, and maintain all equipment/systems installed as a part of this contract.

- Teaching students to configure, troubleshoot, perform manufacture rrecommended preventive maintenance, use local laptops to communicate with the chiller, VFD's controls and establish the BACnet comm. Link.

- Educating the students about the topology of the chiller/BAS/EMCS system programming and interfaces.

- Demonstrate how the sequences are written in the BAS and how the BACnet communications are established, addressed, and Licensed.

A list of integrated points shall be provided to the students as part of the training.

All training shall provide end of course testing approved by the manufacture.

The training material shall be approved by the Government prior to the beginning of the training program.

For approval, the Contractor shall provide a Chiller/Compressor System Training Plan and a copy of the Chiller/Compressor System Training Manual for Government Review at least eight (8) weeks prior to the desired start date for training.

The Contractor shall propose a suggested Chiller/Compressor System Training Schedule for approval no less than four (4) weeks prior to the start of that schedule. Development and approval of the timeframe and logistics must be done in coordination with the government, to allow for employees to plan in their schedules to attend the training.

Up to 10 personnel shall be trained.

Training shall be for five(5) calendar days for at least eight (8) hours a day for , new building systems including: the new chiller and one (1) eight (8) hour day for the BAS and one (1) eight (8)hour day for the VFD's.

The government will provide the classroom training facility and hands on shall be on site.

The Contractor shall deliver a Manufacture approved Chiller/Compressor System Training Manual to each attendee of each training session.

The manual shall include the text, graphs, charts, and images to effectively guide the trainees through the training course. The manuals also shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson.

The Contractor shall furnish audiovisual equipment and other training materials and supplies, as required for each training session. Where the Contractor presents portions of the course by

audiovisual material, copies of the audiovisual material shall be delivered to the Government either as a part of the printed manuals or on the same media as used during the training sessions. There shall be complete training modules on stand-alone CD format.

Acceptance of the design at a particular Government site shall be contingent upon the completion of the training program.

The contractor shall provide an approved manufacture certificate of course completion/competence to include all test scores.

Deliverables: Chiller Training Plan, Chiller/Compressor Training Schedule and a Chiller/Compressor Training Manual.

D3070 SYSTEMS TESTING AND BALANCING

Provide complete Testing and Balancing (TAB) of all air and water distribution systems and HVAC equipment.

D307003 HVAC COMMISSIONING

Refer to RFP Part 3 - Project Program, Chapter 2 for Building Commissioning requirements. Mechanical systems to be commissioned, if provided, include HVAC systems and controls, refrigeration systems and controls, renewable energy systems, and domestic hot water systems.

D3090 OTHER HVAC SYSTEMS AND EQUIPMENT

D309001 GENERAL CONSTRUCTION ITEMS

Provide seismic restraints and Comply with the Force Protection Criteria.

D309090 OTHER SPECIAL MECHANICAL SYSTEMS

Provide total energy (enthalpy) type energy recovery wheels (heat wheels) and sensible wheels in the air handling system.

-- End of Section --